Comparison of Hg and MeHg Cycling in a Contaminated Creek with Uncontaminated Systems

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To examine factors controlling Hg cycling total mercury (Hg) and methylmercury (MeHg) concentrations in East Fork Poplar Creek (EFPC), a Hg contaminated system, were compared to uncontaminated systems where atmospheric deposition is the dominant source of Hg. EFPC currently receives a point source Hg discharge (~1000 ng/L) to its headwater and inputs from heterogeneously distributed Hg in creek sediments and bank and floodplain soils. Dissolved organic matter (DOC) concentrations in EFPC are low (< 3 mg C/L) under baseflow conditions, which is similar to other systems with low wetland (< 3%) basin cover. There are strong correlations between dissolved Hg and DOC in most uncontaminated systems with Hg and DOC increasing downstream as inputs from the terrestrial environments increase. This relationship is not observed in EFPC as a result of the high Hg load and low wetland area. An increase in MeHg downstream, which is observed in EFPC, has been observed in both contaminated and uncontaminated systems and this increase is often coupled with an increase in DOC concentration. In uncontaminated systems with DOC concentrations similar to EFPC, MeHg concentrations are often less than 0.05 ng/L but in EFPC concentrations range from 0.01-0.56 ng/L. Higher than expected MeHg concentration in EFPC which contains elevated Hg from nonatmospheric sources suggests that the concentrations or source of Hg can change result in higher MeHg concentration than observed in uncontaminated systems. Sediment Hg concentrations in EFPC are ~1000 times higher than uncontaminated sediments but MeHg concentrations are only 10-100 times higher. Relationships between reduced iron and sulfur and MeHg and mercury methylation potentials (MMP) in EFPC are similar to other systems. MMP in EFPC are similar to those measured in uncontaminated systems but predicted MeHg concentrations, based on MMP and Hg concentration, are higher than observed. Possible explanations for this are increased demethylation or a lower fraction of bioavailable Hg in EFPC compared to uncontaminated creeks. Caution is needed when data from uncontaminated systems is used to explain the cycling of Hg in contaminated creeks. For example, in EFPC parallels between sediment MeHg relationships with redox status can be drawn with uncontaminated systems but relationships with water column DOC and Hg and MeHg differ.